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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

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LUBRICATION

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Knitting Machinery Lubrication

IN the textile industry the process of knitting various types of yarns into fabrics during the past century has been distinctly marked by the development of power knitting machinery of many intricate and ingenious forms. As a result of this advancement the art of knitting has been commercially extended to the production of much of our personal wearing apparel, such as hosiery, underwear, gloves, skating caps, sweaters, aviation helmets and jackets, skirts and blouses etc. and silk and cotton yarns are today as readily knitted into soft beautiful stockings and feminine wear as coarse woolen yarns are knitted into football sweaters. Whatever the type of yarn involved, the process of knitting is relatively the same as to fabric structure.

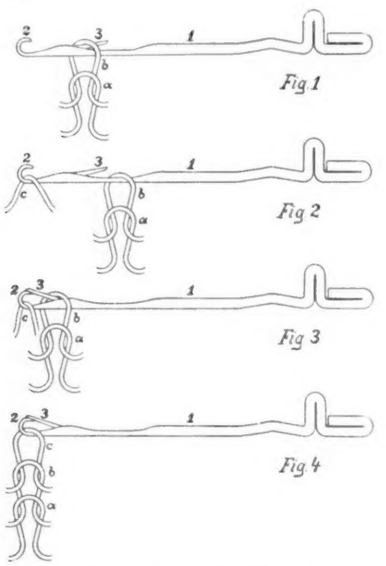
There is a decided difference between the principles of knitting and weaving. Fabrics are produced in knitting by the formation of a series of interlocking loops consisting of one or more continuous yarns, and the operation is carried out by means of knitting needles, of either the latch or spring beard type. Each set of loops is formed on the preceding set, and in consequence any particular loop depends for its support upon the neighboring loops which surround it. This fact leads to both a disadvantage and an advantage. For example, a broken yarn at any point will result in the adjacent loops losing contact, and may easily lead to a considerable hole in the fabric. On the other hand the interlocking nature of the loops results in a far greater degree of stretch and elasticity than is found in woven goods. These properties are the essential advantages pertinent to knit fabrics, and render them without a doubt the most suitable for underwear and hosiery, where the yielding ability of the loops will enable the garment to stretch or contract in conformation with the irregularities and movements of the body.

The average knitted fabric must receive careful attention if it is to be properly made, due to the fact that each loop is worked on its own individual needle, quite independent of those adjacent. Hence irregularities, or a variation in the tension of the winding of the yarn will affect the construction of the fabric.

Weaving, on the other hand, is the crossing or interlacing of a relatively large number of warp and filling yarns at right angles to each other, as has been discussed in previous articles in LUBRICATION*. In woven fabrics the yarns exert far more of a grip on one another, and the goods have much greater rigidity and possess relatively little elasticity,

*See LUBRICATION for Sept., 1920 and April, 1923.

yielding only slightly to normal strains. For this reason woven fabrics are ideally adapted to garments which are subjected to considerable frictional or abrasive wear, such as suits and coats, etc.



Courtesy of "Wool, Cotton, Silk" etc. by E. A. Possell

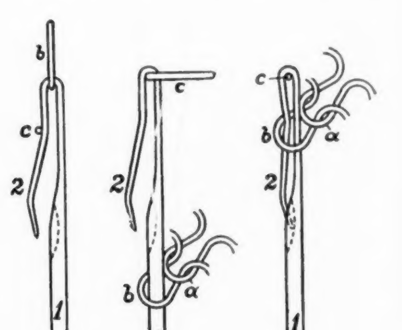
Fig. 1.—Illustration of the principles of operation of the latch needle. Though shown in horizontal position the needles work vertically or inclined. Fig. 1 shows the start of a loop, Figs. 2 and 3 being intermediate steps, and Fig. 4 the finished loop "cast off". "1" indicates the body of the needle, "2" the hook, "3" the pivoted latch, and "a", "b", and "c" the loops of yarn.

Types of Needles and Stitches

Inasmuch as knitting machinery involves a distinctive process, it is essentially similar in principle and operation for all grades of yarns and fabrics, the only characteristic features that differ being the design of the needles employed, their arrangement and the loops to be formed. As has been stated, there are two types of needles: the latch and spring beard.

The *latch needle* is constructed with a hook formed in its upper end and a pivoted latch located on the shank below so as to be capable of swinging over and closing the hook. The formation of the loop is brought about by reciprocating motion of the needle in the machine and the alternate opening and closing of the latch which carries the yarn into desired position. Latch needles are for the most part located vertically in circular knitting machines, and in an inclined position on the flat knitting machine. They are chiefly used on circular knitting machines today. At the beginning of a stitch the latch is thrown back and the loop of the previous stitch rests upon the shank as the needle rises; when it reaches the top of its travel the yarn is deposited in the hook by a suitable mechanism. The needle then begins its downward stroke and the latch is closed over by the loop which remains practically stationary. Further depression of the needle causes the loop to slip over the end of the closed hook or be "cast off." The needle is then in position to rise and form a new loop. The location of a number of such needles side by side in their proper working position in the machine, thus brings about the formation of a series of interlocking loops and a desired web at every course.

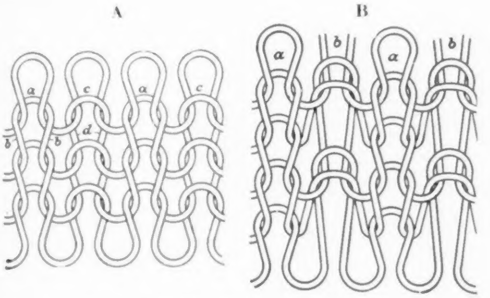
Knitting with but one set of needles forms what is known as a plain stitch web, with a smooth inside surface to the fabric, or a variation known as the mock rib stitch. The use of two separate sets of needles enables the knitter to fabricate what are known as rib, and tuck stitches. In the rib stitch both sides of the fabric present the same appearance; the elasticity of this style of stitch is particularly adaptable to underwear wrists and the tops of half hosiery. Rib stitches may be varied as desired by arranging the two sets of needles accordingly; for example, a 3 to 1 stitch would require three needles of one set arranged so as to alternate with one needle of the companion set. The tuck stitch is a variation of the rib stitch, being developed by the use of two sets of



Courtesy of "Wool, Cotton, Silk" etc. by E. A. Possell

Fig. 2.—Details of the principles of operation of a spring beard type of needle. At "1" is shown the body of the needle; at "2" the spring beards; and at "a", "b", and "c" the loops of yarn at various stages of knitting.

needles as above, and on the same machine, simply by the operation of certain cam mechanisms. The mock rib stitch is frequently used instead of the rib stitch on certain fabrics, and may be made on a plain stitch machine; usually this stitch is more applicable to spring needle machines than to the latch type of needle.



Courtesy of "Wool, Cotton, Silk" etc. by E. A. Posselt.

Fig. 3.—Magnified details of yarn looping as embodied in basic rib and tuck stitch formation. At "A" is shown the "rib" web, while "B" represents a tuck stitch web. Method of interlocking loops in each case is clearly evident.

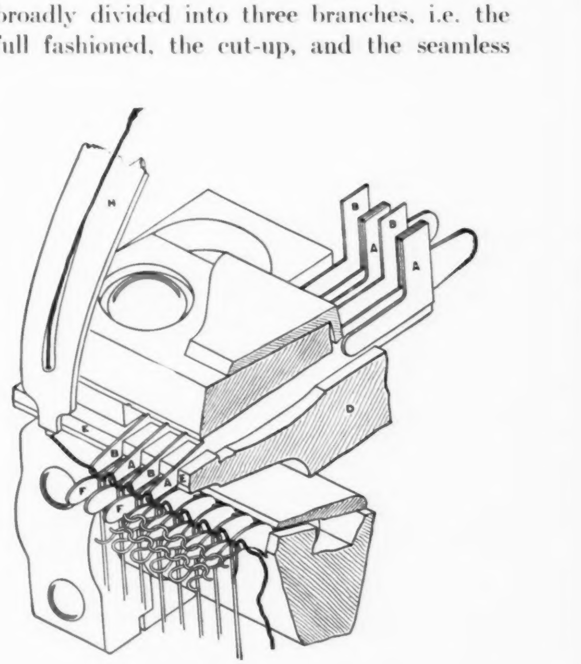
Spring Beard Needles differ markedly from latch needles, both in their construction and method of operation, although they are capable of producing the same types of stitches as above. The essential difference between them is in regard to the style of hooks, and needle control. In knitting with the latch needle machine the needles work in a limited space and each performs its function by separate and individual movement. In spring needle knitting, on the other hand, the needles move as one.

On the flat knitting machine usually two or more needles are fixed in a lead carrier, the width of the latter and the distance between the needles being determined by the gauge or number of needles per inch. These leads are fixed side by side in a needle bar which is set horizontally in the machine.

Spring beard needles are shaped much like an elongated hook, the end of which is capable of a certain amount of spring which enables the tip or spring beard to be pressed against a notch in the shank of the needle when the yarn loop is ready for casting off. Both the yarn loops and spring tips are controlled and manipulated throughout the process of forming a loop by special burred wheels or pressers operated by cams, suitably installed in the machine. The sequence and essential principles of operation are interesting. At the start of a loop or course the preceding loop rests in the hook of the needle, the new yarn being stretched at right angles across the spring beards by the yarn carrier. The next step involves the moving of both the preceding loop and the yarn down the needles, the former resting on the shanks below the spring beards while the latter is run up under the tips and into the hooks by its controlling mechanism. Casting off of the loop is then brought about by the spring beards being pressed into their respective slots by burrs or pressers and the preceding loops of the fabric being drawn up and over the tops of the needles, thus causing the formation of a new course of loops. The needles are then in position to again receive yarn.

Branches of the Industry

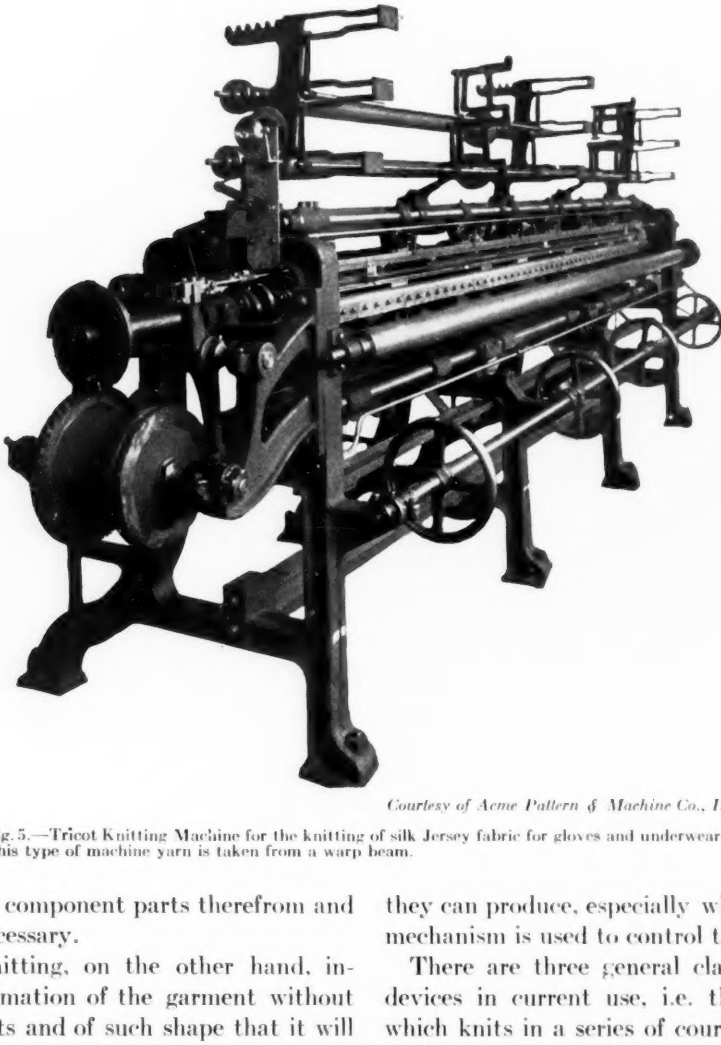
The knitting industry in general can be broadly divided into three branches, i.e. the full fashioned, the cut-up, and the seamless



Courtesy of Textile Machine Works

Fig. 4.—Details of needle, sinker and divider arrangement on a full-fashioned knitting machine. "A" indicates the sinkers which push the yarn between alternate needles; at "B" are shown the dividers located between the sinkers; "E" is the presser edge which presses the needle beards into their respective grooves to form a closed eye; "D" is the sinker bed; "F" indicates the knock-over bits which serve to finish the loops; and "H" is the yarn carrier.

trades. In the first the garments are knitted to the shape of the body and in finishing they require seaming or joining according to the type of wear they are prepared for. In the cut-up trade the fabric is produced in tubular or broad flat pieces and the garments are made



Courtesy of Acme Pattern & Machine Co., Inc.

Fig. 5.—Tricot Knitting Machine for the knitting of silk Jersey fabric for gloves and underwear, etc. In this type of machine yarn is taken from a warp beam.

by cutting the component parts therefrom and seaming as necessary.

Seamless knitting, on the other hand, involves the formation of the garment without seams or joints and of such shape that it will fit the wearer. Such fabrics are made on circular knitting machines, and include hosiery, tubular underwear, and nightdress materials. By use of the rib stitch sufficient elasticity can be imparted to the goods so that fitting to the body is readily accomplished.

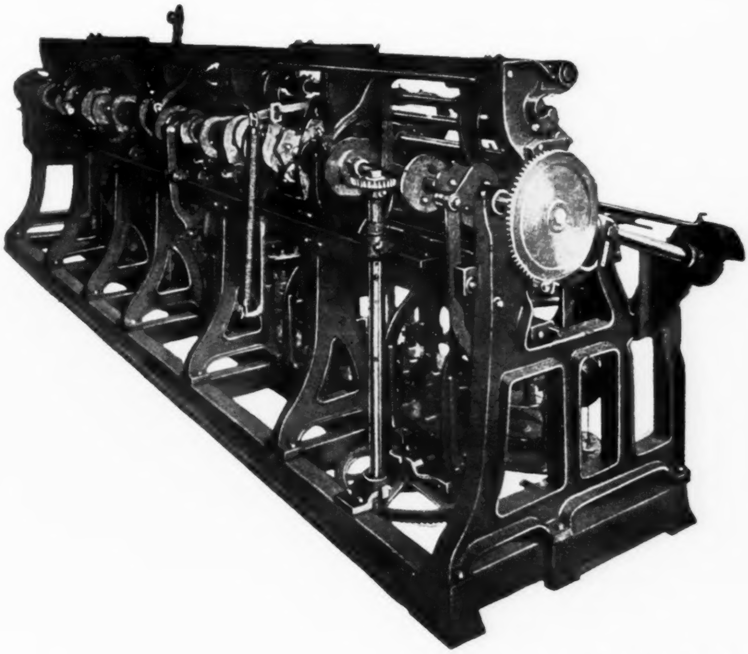
Types of Machines

Knitting machinery as involved in any of the above branches can be generally considered as producing the fabric either in flat or in tubular form. Flat knitting machines, according to their design, employ both latch and spring beard types of needles and they are remarkable for the great variety of patterns, stitch combinations, and grades of fabrics they can produce, especially where a Jacquard mechanism is used to control the design.

There are three general classes of knitting devices in current use, i.e. the flat machine which knits in a series of courses, taking yarn from cones or bottle bobbins, and producing much of our full-fashioned hosiery; the circular or rotary machine as mentioned above; and the warp knitter which customarily employs spring beard needles to knit the yarns which are taken from a warping beam or series of warp drums. Warp knitting is perhaps the most intricate and interesting procedure in the industry today. One of three types of machines is usually employed for this purpose, i.e. the

Tricot, the Milanese or Traverse, and the Jacquard Raschel.

Tricot knitting differs from straight knitting essentially in the formation of the fabric, and it is extensively used in the manufacture of silk Jersey cloth, gloves and silk underwear. That is, instead of continuously looping a relatively small number of yarns over each other a process of interlacing a larger number of parallel warp yarns is employed. Prior to knitting, the yarn must be wound on a warp beam in much the same manner as in the weaving mill. Having inserted the beam in the knitting machine and properly started the fabric by the formation of an initial row of loops, subsequent knitting is simply an automatic continuation of this process.



Courtesy of Acme Pattern & Machine Co., Inc.

Fig. 6.—Rear view of a Milanese Warp Knitting Machine for knitting silk fabric. Cam operating mechanism is plainly evident.

The Milanese or Traverse machine is also used for knitting silk fabrics. It is not, however, considered as being adaptable to the production of patterns due to its complexity and delicate construction, being chiefly used for knitting flat lengths of uniform fine texture. In the Milanese machine the warp is wound on brass drums and the spring needles average about 28 to the inch, being located horizontally instead of vertically as in the Tricot machine.

The Jacquard Raschel machine is used for the knitting of scarfs, veils and curtain goods. It is capable of producing a variety of beautiful patterns by virtue of being able to control the yarns individually instead of collectively as is the case on a cam operated knitting machine such as the Tricot or Milanese. On this machine a Jacquard mechanism similar in operation to that used in the weaving industry* governs the formation of the design. The modern type of Jacquard Raschel machine includes a needle bar working in conjunction with suitable guides. The formation of the pattern is attained by string connections leading from the Jacquard mechanism to individual jacks which automatically deflect the guides according to the card perforations. By this deflection of the guides the yarn is thrown over the needles as desired.

*See LUBRICATION for April, 1923.

Lubrication of Knitting Machinery

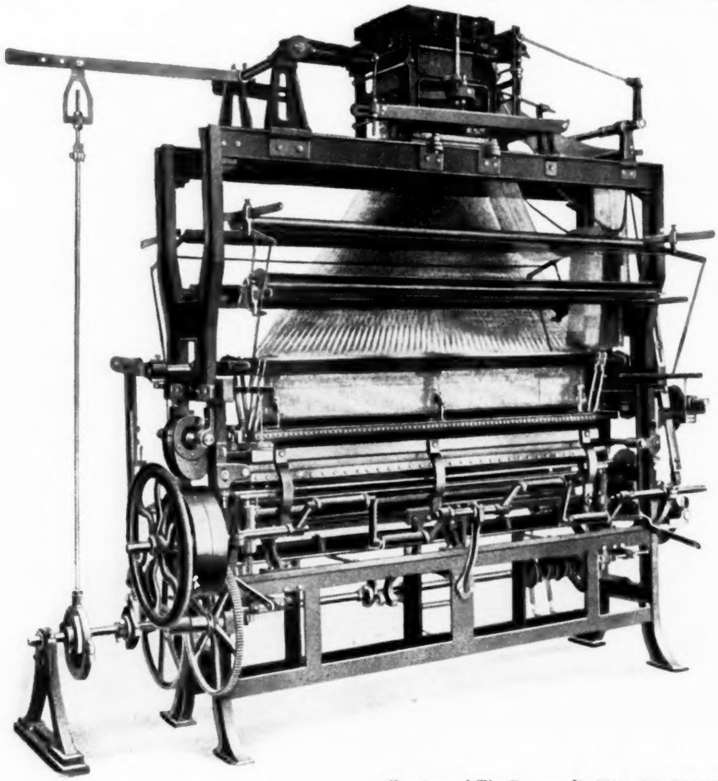
As in other branches of the textile industry lubrication plays an important part in the knitting mill, and such factors as

(1) Power losses
(2) Machine friction losses
(3) Oil stained fabrics
(4) Replacement losses
(5) Rate of production and
(6) Repair expense

enter markedly into the cost of production. In order to reduce losses, oil stains and repair expense, etc., and keep production at a maximum the purest grades of lubricants should be used at all times. Generally speaking, knitting machinery, whatever its type or function, can be lubricated by three grades of lubricants, i.e. a compounded stainless knitting oil of about 100″ Saybolt viscosity at 100° F. for such mechanisms as are located in close proximity to the fabric, and from which oil drips might occur to damage the latter; a straight mineral engine oil of from 180″ to 300″ viscosity for shaft bearings, cam mechanisms, roll bearings and electric motors throughout the mill; and a pure grade of liquid grease free from acid or alkali, for the miscellaneous gears and driving chains that may be installed.

Warp Knitting Machines

Warp knitting machines of the Tricot, Milanese and Jacquard Raschel types will require careful lubrication of the needle, guide, sinker and presser mechanisms, etc. In general the lubricant, which should be a high grade stainless knitting oil, must be carefully and sparingly applied, to prevent access and possible damage to the fabric. The cams and other operating mechanisms, including bearing boxes, should also be lubricated with the same oil, similar care being exercised in its application. Such other operating parts as frame bearings, motors, driving gears, and chains are less apt to cause damage to the fabric through faulty lubrication; yet to insure economy and maximum production their lubricants must also

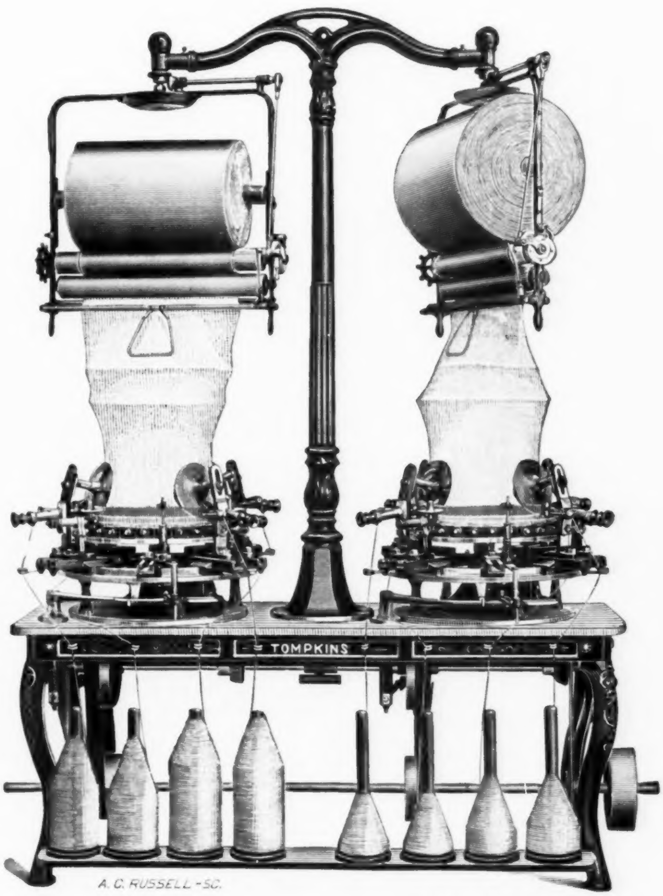


Courtesy of The Grosser Knitting Machine Co.

Fig. 7.—Jacquard Raschel Machine for the knitting of shawls, laces and veils. This machine uses spring beard needles, and the pattern is controlled by the Jacquard Machine located overhead.

be carefully selected and applied. For roll and motor bearings a straight mineral engine oil of from 180″ to 200″ viscosity is recommended. For gears and chains a relatively heavy grade of liquid grease will serve the purpose admirably.

ming. Were the oil to gum and become relatively stiff the rollers would work sluggishly and abnormal wear would be apt to occur. It is therefore advisable to watch such mechanisms carefully, and even though the best grade of



Courtesy of Tompkins Bros. Co.

Fig. 8.—Circular Spring Knitting Machine used for the manufacture of tubular products. This machine can be used for all grades of yarn, such as silk, cotton, wool and worsted, depending on the gauge or number of needles to the inch.

Circular Knitting Machines

In circular or tubular knitting machines a point where careless selection and application of the lubricant may cause trouble is on the roll take-ups and worm gear attachments which serve to keep the fabric under uniform tension during knitting. For this service a pure stainless knitting oil should always be used in order not only to eliminate excessive loads upon the needles but as well to prevent gumming.

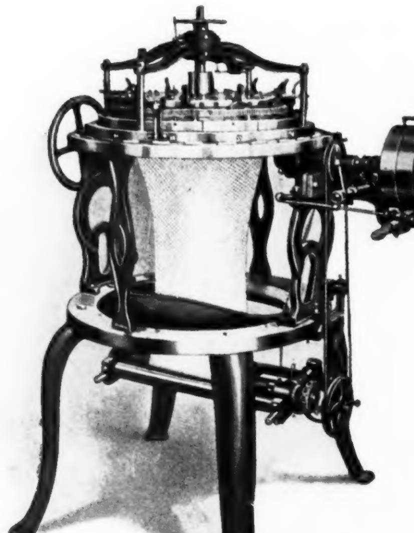
oil is used, to remove and rinse them in kerosene about once every month to insure that they are perfectly clean and free from gummed oil or accumulated dust and lint.

To prevent oil spots on the fabrics, needle cylinders and dials on certain of the circular knitting frames must also be oiled carefully. Self-feeding oil cups are sometimes installed on the machines for this purpose but owing to their positive action, unless promptly turned off whenever the machine is stopped, they will

tend to flood the working parts and cause serious oil spots or even streaks.

Application of Lubricants

Knitting machines may be lubricated either by the machine operators themselves or by a



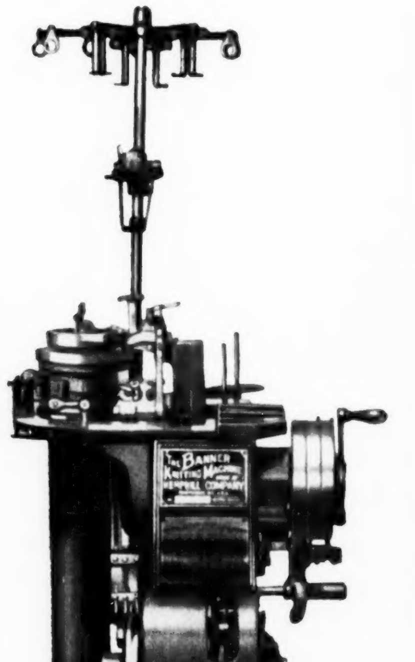
Courtesy of Scott & Williams, Inc.

Fig. 9.—Type of Circular Knitting Machine used in the manufacture of porous mesh underwear.

mechanic or fixer who has charge of entire plant lubrication. There are advantages and disadvantages pertinent to both methods although the latter is perhaps the most satisfactory unless the individual operators are properly instructed as to the manner in which their machines should be lubricated. At all events whoever has this duty to perform should fully understand the machines and their respective parts that require lubrication, and should appreciate the detrimental effects that careless, sloppy or excessive oiling may have upon the knitted fabric. Knitting machines should be lubricated at regular intervals, the frequency to be based on their actual time of operation.

Conclusion

The essential point to remember in the lubrication of knitting machines is that the least amount of oil that will adequately lubricate the working parts is the best insurance against the occurrence of oil spots. If in conjunction with such a policy, the best grade of stainless knitting oil is used wherever there is danger of dripping or splashing, the lubricating problems in the knitting mill should be practically eliminated.



Courtesy of Hemphill Company

Fig. 10.—Spring Beard Needle Knitting Machine as used for the manufacture of all classes of seamless hosiery. This machine is equipped with a revolving cylinder and stationary cams.

Textile Printing Machinery and its Lubrication

PRINTING of textiles, such as silk and cotton fabrics, differs materially from the process of dyeing, in the method of application, although the purpose is relatively the same, i.e. to bring about the formation of color effects. Essentially textile printing is a method of surface coloring, the pattern being impressed upon the fabric by the use of a pressing device and the employment of pigment colors. On the other hand, dyeing involves the fixing of colors in the fabric by a process of saturation in baths of fluid coloring matter.

Textile printing can be broadly classed as hand block and machine printing. Both methods are essentially alike from a chemical viewpoint. The former, while it is a relatively slow and expensive procedure is capable of producing certain artistic effects on printed fabrics that are otherwise more difficult to obtain.

Hand Block Printing

Hand printing is in effect a process of repetition dependent upon the number of colors in the pattern and the length of the piece. Previous to printing, the goods must be suitably stretched over what is known as a printing table. Then the procedure is to accurately set an engraved hard wood print block, which has been suitably inked, upon the fabric, the location being controlled by registration points on the block. The color is transferred from block to fabric by tapping the former with a mallet. The block is then lifted from the fabric, re-inked and once more located according to the desired repeat in the pattern.

The printer is able to print in one color only at a time, hence if four colors should be desired the usual procedure would be to print the piece on the table in four operations, using a hard wood print block as already mentioned, suitably engraved with the pattern cut in relief similar to the rubber desk stamp, to give the color intended for each step. Printing tables in this process vary from five to fifty feet long. Therefore it can be appreciated that hand printing of a multi-colored pattern on a piece of goods considerably longer than the table, would entail many trips up and down the table before the pattern was completed, and the goods might have to be rolled and shifted along quite a number of times.

Machine Printing

Machine printing involves a number of processes such as the intaglio method, surface printing, and the machine block. The latter two are of little concern herein, machine block printing being used primarily for oil cloth, linoleum and other floor covering patterns, while surface printing is confined solely to special patterns on extremely thin fabrics.

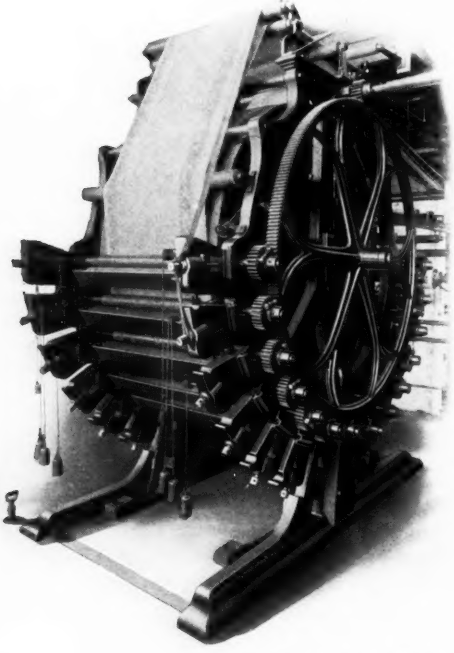
The intaglio method as incorporated in the rotary textile printing machine predominates in the industry today, due to facility with which patterns of almost every conceivable type can be printed at one operation with accuracy and uniformity, using from one to fourteen colors to bring out the effect.

By the word "intaglio" is meant the countersinking or engraving of the patterns on the printing rollers, somewhat similar to the engraving of a visiting card plate. On rollers intended for printing more simple patterns of from one to four colors, engraving is done by pressure, using a steel mill with the pattern raised in relief thereupon. The mill and roll are installed in a suitable machine and rotated in contact with each other under pressure. Thus the engraving on the mill is sunk into the roller as desired.

When more complicated patterns of a relatively large number of colors are desired, however, the pantograph process of engraving is preferred. This involves the etching of the design by acid into the roller surface, after the pattern has been suitably applied and located upon the roller, the surface of which has been previously coated with an acid resisting paint.

The operation of a rotary textile printing machine involves quite a considerable pressure

upon the roll necks and bearings, in order to properly impress the pattern upon the fabric; hence the general construction must be comparatively massive and rigid. The working mechanisms and their operation in such a machine are of interest. The essential parts



Courtesy of Rice, Barton & Fales, Inc.

Fig. 11.—Type of Rotary Textile Printing Machine used in the printing of cotton and silk fabrics. This machine is capable of printing in 14 colors or less, if desired.

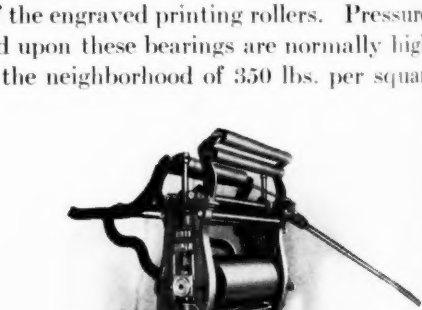
are: the supporting or side frames; the main or platen cylinder which carries the goods and revolves on a central shaft suspended by the side frames in suitable bearings; the engraved copper rollers and mandrels or revolving shafts upon which they are carried; the color pans, and color furnishing rollers from which the printing rollers receive their color; the "doctors" or blades which are designed to remove excess coloring pigment from the printing rollers; the pressure screws by which pressure between the printing rollers and fabric upon the platen or main cylinder is regulated; and the various driving and intermediate gears, etc.

The process of setting up such a machine for printing involves a number of points wherein considerable care must be exercised. For example the copper print rollers must be accurately located on their respective mandrels, not only to enable coloring to be applied in the right sequence but as well to insure proper fitting of each color to form the finished pattern. Pressure screws on the mandrel rollers must be so tightened that there is equal pressure along the entire length of the rollers to insure even printing. Color doctors must set so as to properly remove all excess color from the print rollers except that which is to be applied to the fabric, and color furnisher rollers must be well supplied with color, and the latter must be of the right consistency so that the entire engraving on the print rollers will receive the correct amount of color.

With the machine thus set for printing, the actual operation is to run the fabric from suitable rolls through the tension bars, passing it between the main roller and the print rolls. Following this the fabric passes through some form of dryer and then a steamer to firmly set the color. Final treatment will include cleansing, starching, tentering, can drying or calendering to stretch, dry or iron the goods; and packing for the market.

Printing Machinery Lubrication

The essential problem that is usually met with in the lubrication of a rotary textile printing machine involves the mandrel bearings of the engraved printing rollers. Pressures exerted upon these bearings are normally high, i.e. in the neighborhood of 350 lbs. per square



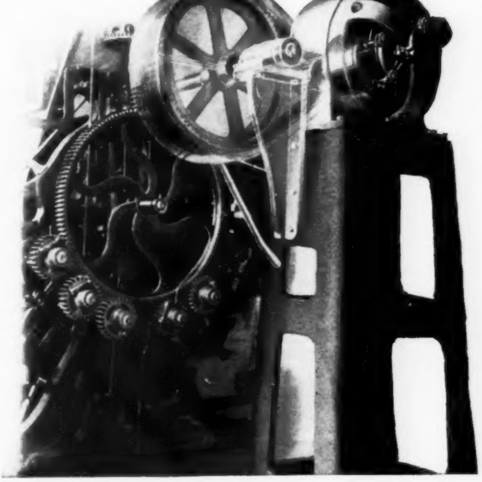
Courtesy of Rice, Barton & Fales, Inc.

Fig. 12.—Machine for the printing of textiles in one color only. The simplicity of this machine as compared with a 14 color machine is evident, although the principles of operation are relatively the same

inch, and the difficulty is to obtain a lubricant that will have sufficient viscosity to resist being squeezed entirely out from between the roll necks and the bearings, and that will insure as low operating temperatures as possible. The bearings for such rolls are usually built of split bronze or brass sections with no oilways cut in their surface. Thus the only means by which the lubricant can work its way between the wearing surfaces is along the chamfered edges of the bearings. Although the operating speed of such machines is relatively low, and 50 to 60 yards of fabric per minute is the average production, it is often difficult to keep the temperature of the mandrel neck and bearings comfortable to the touch, and frequently they will run so hot as to cause smoking or even the flashing of the bearing lubricant, especially when the pressure screws are set up to their tightest.

There are normally no means installed for the mechanical lubrication of such bearings, and general custom is to lay an oil or grease soaked pad of some form or other onto the rolls. A number of types of lubricants have been used for this purpose at various times. Some operators prefer to use beef tallow or a high melting point grease, which is placed in a cotton bag and stuffed between the mandrel and its respective socket in the side frame. Other plants use simply a lump of suet as the lubricant. Experiments have proven, however, that a fairly high fire point (in the neighborhood of 440° F.) liquid mineral lubricant having a viscosity of about 200″ Saybolt at 210° F. is usually most suitable for this purpose, and best practice is to use a felt pad of such a size as to fit over the entire exposed surface of the mandrel. This felt should be soaked in the oil for approximately 10 to 12 hours. Then it should be removed and allowed to drain of the surplus lubricant. The frequency with which such felt should be soaked will, of course, depend upon the operating conditions. Once a week has proven satisfactory in many plants. In event of operating rotary printing machines under excessively high pressures it may be advisable to use an extremely high fire point (in the neighborhood of 600° F.) cylinder oil which would have a viscosity of about 160″ Saybolt at 210° F.

However the lubricant is applied there must be ample provision for the withdrawal of the lubricating medium promptly in event of the bearing becoming dangerously hot, before the lubricant shall have a chance to take fire. This is usually done by simply pulling out the oil



Courtesy of Rice, Barton & Fales, Inc.

Fig. 13.—Details of Silent Chain Motor-drive Equipment as attached to a modern rotary textile printing machine. Gear drives and mandrel rolls are also clearly shown.

pad with a string or pair of pliers. If this crude preventative is not carried out and should the lubricant flash and burn, there would be considerable probability of the fabric being charred or even burned before the blaze could be extinguished and the mandrel cooled down.

Other working parts in such a machine that require lubrication are the driving and intermediate gears, the silent chain motor drive equipment used in the modern presses, and the miscellaneous roll bearings, etc. None of these parts will normally give rise to lubricating difficulties. For gears and chains a pure mineral gear compound having a viscosity of from 1000″ to 2000″ Saybolt at 210° F. will be suitable.

The bearings of the main or platen cylinder are normally not subject to excessive pressure or temperature, and they as well as other smaller bearings, including those of electric motors, can be lubricated with a pure mineral engine oil of from 180″ to 300″ Saybolt viscosity at 100° F.

On certain older design rotary printing

machines, steam engine drive may be still in use. Engines for this purpose are usually set on an angle and are known as the Side Hill type. For steam cylinder lubrication of such engines a compounded cylinder oil of from 130″ to 150″ Saybolt viscosity at 210° F. will serve the purpose, due to the fact that they will usually be driven by relatively wet steam. Other working parts of such engines can be lubricated with the lighter engine oil as recommended above for miscellaneous bearing lubrication.

Preservation of Fish Nets

IN the deep sea fishing industry where stake nets or so-called fish pounds are employed it is general practice to dip the nets in some form of adhesive preservative at least once a season in order to strengthen the twine and at the same time to overcome as

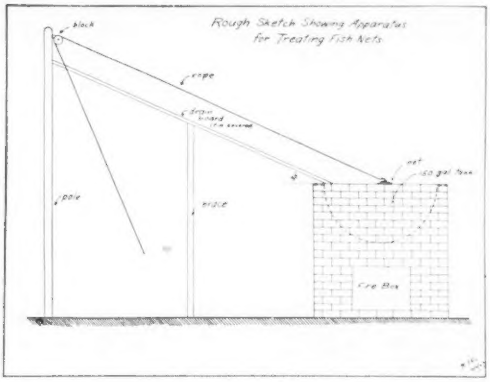


Fig. 14.—Sketch illustrative of an efficient means of treating fish nets in heated petroleum compound in order to preserve the twine and counteract the formation of marine vegetable growth.

much as possible the tendency for an accumulation of marine vegetable growth which would close up the mesh to a considerable extent. Coal tar or pine tar have been used quite generally for this purpose until recently when extensive experiments proved that a petroleum compound was far more satisfactory.

In the use of tars there have always been certain disadvantages present, i.e. tar will tend to dry and become hard and brittle. Thus when the nets are handled the tar film on the twine will very often crack and in so doing will cut or damage the fibres to such an extent that they break in a short time. In addition tar does not satisfactorily overcome the growth of vegetable matter such as sea grass. As a result thereof the meshes of the net will be closed up to a certain extent, as has been stated above. This growth will be especially prevalent on what is termed the "weir-net" with the result that a heavy resistance will be offered to the action of the tide, and in event of a high sea the nets will tend to tear completely away from the "weir-poles" on which they are fastened, resulting in the loss of fish and considerable damage to the entire net.

In order to overcome the above disadvantages, experiments have been carried out, using a comparatively heavy petroleum compound having a viscosity of approximately 200″ Saybolt at 210° F., and extremely adhesive and penetrating in its nature. This compound does not crack, become brittle or dry out even when exposed to low temperatures or in the presence of sea water. Therefore it does not damage the net twine as tar would, and due to its ability to penetrate the twine the mesh remains soft and pliable at all times. This is a great advantage to the fisherman when putting out nets, since they can be rolled up into a relatively small bundle, as compared with a tarred net. In addition the accumulation of sea grass and other marine vegetable growths is considerably decreased.

In order to properly treat a net with such a compound the latter should be heated to approximately 175° F. in a suitable tank, as shown in the accompanying illustration. Then the nets should be submerged therein to obtain a thorough saturation, after which they should be pulled up along a drain board by block and fall in order to allow any surplus compound to drain back into the tank. Care must be taken not to exceed the above temperature to any great extent, since net twine will tend to lose its natural elasticity at a temperature of approximately 220° F.

By the use of a similar though heavier compound having a viscosity in the neighborhood of 2000″ Saybolt at 210° F. as a protective coating for the "weir-poles", the usual rapid deterioration due to presence of mussel formations and boring worms is also prevented.

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